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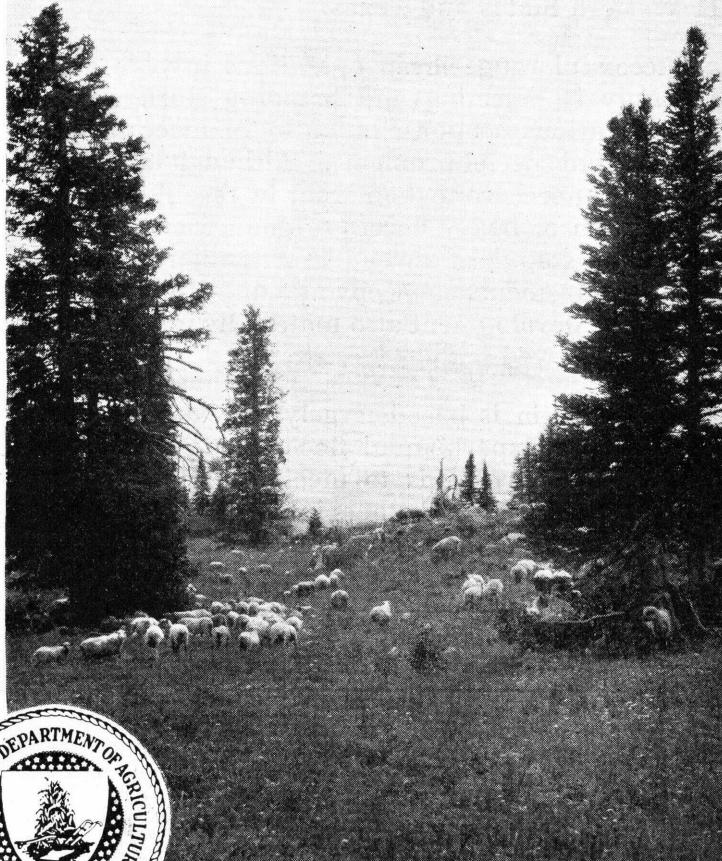
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RANGE SHEEP
PRODUCTION



OWING to insufficient rainfall, rocky soil, and other causes, much of the area in the Western States is unsuitable for tillage but is well adapted for grazing. In this so-called "range area" an extensive sheep industry has developed; in fact, more than 60 percent of the sheep in the United States are in 11 Western States and Texas.

Successful range-sheep operations involve ability not only in selecting and breeding stock adapted to the various sections, but also in meeting many hazards and special problems. Although lambs have returned more profit than wool in recent years, the production of heavy fleeces of good wool is still an important source of revenue. Attention to the seasonal requirements of sheep and lambs for their most profitable development also materially influences the returns received.

This bulletin is based largely on experience and results with experimental flocks in the area mentioned. Its purpose is to meet the demand, from western sheepmen and others interested, for information on sound methods of range sheep production.

Washington, D.C.

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RANGE SHEEP PRODUCTION

By J. M. COOPER, *associate animal husbandman, Animal Husbandry Division, Bureau of Animal Industry*

CONTENTS

	Page
Development of the range sheep industry-----	1
Types and breeds of sheep on western ranges-----	2
Finewool breeds-----	2
Longwool breeds-----	2
Down breeds-----	2
Minor range breeds-----	4
Crossbreds-----	4
Selection of breeding stock-----	6
Market-lamb production-----	6
Stock-sheep production-----	7
Purebred-sheep production-----	7
Selection of rams-----	9
Selection of ewes-----	9
Replacement of ewes-----	9
Management of range sheep-----	10
General organization-----	10
Breeding-----	10
Winter handling-----	11
Management of range sheep—Continued-----	14
Spring handling-----	25
Summer and fall handling-----	27
Marketing-----	27
Fat range lambs-----	27
Feeder lambs-----	27
Feed-lot lambs-----	27
Purebreds-----	28
Surplus ewes-----	28
Wool-----	30
Causes of losses-----	32
Poisonous plants-----	32
Other plants-----	32
Diseases-----	32
Parasites-----	33
Predatory animals-----	33
Other causes of loss-----	34

DEVELOPMENT OF THE RANGE SHEEP INDUSTRY

BECAUSE of shallow rocky soil, arid and often severely cold climate, rough topography, and a comparative lack of transportation facilities, much of the western range country is unsuited to crop farming and the support of dense populations. It is, therefore, probable that this region will continue to support large numbers of grazing animals. More than 60 percent of the sheep in the United States are in the 11 Western States and Texas. The estimated value of the sheep in these States exceeds \$100,000,000, and for every dollar invested in sheep several dollars are invested in land, equipment, feed, labor, and other factors incidental to operation. Accordingly, the great importance of the sheep industry in the range area of the West is evident.

The sheep of the West had their origin principally in two distinct sources—improved types brought from the East and unimproved native sheep trailed from the Southwest. The native sheep were undoubtedly descended from Spanish stock brought into Mexico and California by early Spanish explorers. Many years of uncontrolled breeding had reduced these animals to a very inferior, light-shearing type. After being brought to the western range country these sheep were greatly improved by intelligent breeding practices and the introduction of new blood.

Formerly, because of an abundance of free range and cheap labor and the long distances to market, few young sheep or lambs were marketed. The wethers were kept in large bands until 3 or 4 clips

of wool had been obtained and then they were shipped to market. Production costs were low, and the season's wool clip made a compact, relatively nonperishable product, well adapted to the long hauls over poor roads to the shipping points.

In recent years lamb or mutton has taken the place of wool as the principal source of revenue from range sheep. This change has been brought about largely by the reduction of free range, the advent of better transportation, and the increased market demand for lambs. The range sheepman accordingly markets most of his lambs at from 4 to 6 months of age and retains only the ewe lambs necessary to maintain his band.

TYPES AND BREEDS OF SHEEP ON WESTERN RANGES

In almost every section of the West various types and breeds of sheep have been used in an effort to find the kind best adapted to each particular section. The predominant present type is the finewool sheep or one which has a foundation of finewool blood. Formerly the Merino was very largely used, but the larger, smoother, more productive Rambouillet has rapidly taken its place. Various other blood lines involving principally the longwool and "down" breeds have been used, either pure or crossed with the finewool breeds.

FINEWOOL BREEDS

The finewool breeds, Rambouillet and Merino, are particularly adapted to much of the western range. They are hardy and can withstand short feed and drought. In addition, their strong herding instinct makes it possible for one man to take care of large numbers even in rough country. The Rambouillet ewe (fig. 1) is a fairly good mother, produces an acceptable feeder lamb, and has a longer-stapled fleece of less shrinkage than the heavily wrinkled type of Merino. The Rambouillet ewe is generally used as the foundation for the production of the crossbred, so desirable for the raising of fat lambs on the high western ranges. As compared with the Rambouillet, the heavily wrinkled type of Merino is a relatively poor mother. For these reasons the Rambouillet has rapidly taken the Merino's place on the range. Some success has been achieved in breeding Merinos for freedom from heavy skin folds, but the progress has not been so great as with Rambouilletts.

LONGWOOL BREEDS

The longwool breeds include the Lincoln, Cotswold, Leicester, and Romney Marsh. These breeds are undesirable as range animals because of the difficulty in herding, lack of hardihood on the range, large coarse lambs, and extremely coarse fleeces. The few longwool sheep that are raised in the range country are produced on a small scale under fence, for the production of rams. The rams, particularly the Cotswold and Lincoln (fig. 2), are used on the range to cross with the finewool ewes in the production of the popular crossbred ewe type.

DOWN BREEDS

The Hampshire and Suffolk breeds are used in the western range country for the production of market lambs. The purebred Hamp-

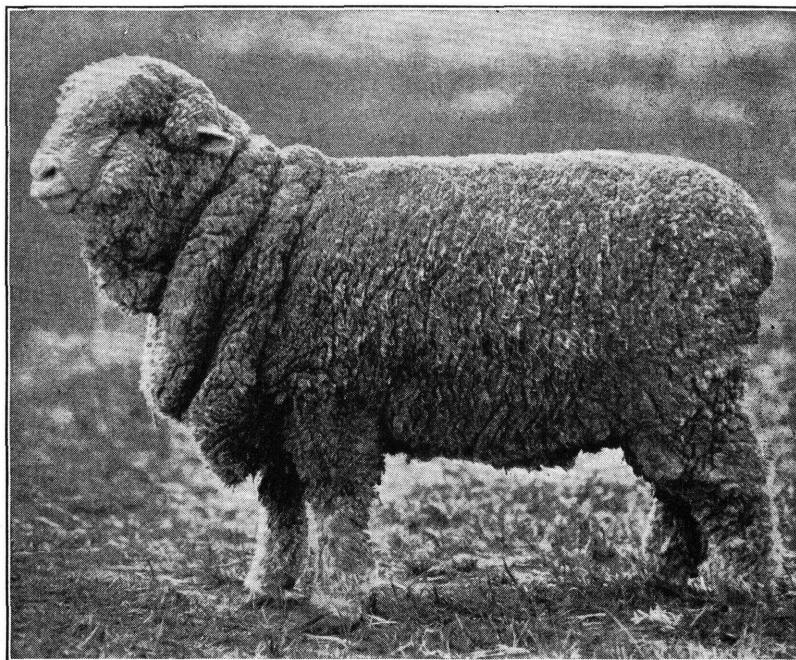


FIGURE 1.—A Rambouillet ewe typical of many finewool ewes on western ranges. Range-men are breeding not only for such smooth-bodied sheep, but for freedom from the large neck folds that this ewe has.



FIGURE 2.—Lincoln ram, a sheep of the longwool type.

shire also is raised in comparatively large numbers, but it does not have the herding instinct and is a very poor wool producer under range conditions. It is kept primarily for the production of breeding rams. Hampshire rams (fig. 3) are very popular and are used largely on crossbred and finewool ewes. The Suffolk (fig. 4) is used to a limited extent in a few localities. The purpose and the general type of lamb produced are essentially the same as in the case of the Hampshire.

MINOR RANGE BREEDS

The Karakul, Tunis, and other minor breeds of sheep have been used to a very limited extent in some sections of the West, but it appears that they will continue to have only a small place in the range sheep industry.



FIGURE 3.—Hampshire ram typical of those used on the range to sire market lambs.

CROSSBREDS

Strictly speaking, a crossbred sheep is the result of crossing any two distinct breeds, but as applied to western range sheep it ordinarily refers to the crossing of a longwool and a finewool breed. Rams of the longwool breeds previously mentioned are used on the Rambouillet and Merino ewes, but the most popular longwool rams are the Cotswold and Lincoln.

The crossbred ewe has enough of the finewool blood to be easily herded. She is more prolific than the Rambouillet and is an excellent mother. In addition, her fleece is long, heavy, light shrinking, and of desirable quality. Most western fat lambs are produced by using rams of the down breeds, notably Hampshires, on crossbred ewes. When weaned after summering on the high ranges of the national forests, these lambs are a very superior product.

Lambs produced by crossing (1) the Hampshire and a finewool breed, and (2) the Hampshire breed and crossbreds, are of desirable mutton conformation, mature early, and are very popular with both the producer and the meat trade. The drawback in the use of the Hampshire, which is a mutton breed, is that the tendencies of the lambs to produce light fleeces make it necessary for both ewe and wether lambs to be sent to the block, and the producer, therefore, must make other arrangements to obtain replacements to keep up the ewe flock.

Recognizing the desirability of a sheep that combines the longwool and finewool type and that also breeds true, western sheepmen have developed several types and breeds. The best known is the Corriedale (fig. 5), which originated in New Zealand as a cross between the Lincoln and Merino. Because of its foundation of Merino blood,

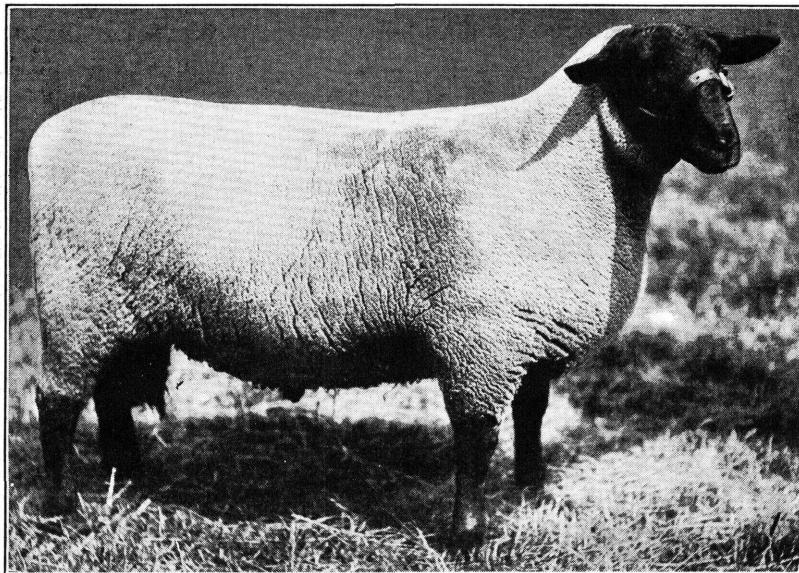


FIGURE 4.—Suffolk ram.

the Corriedale is somewhat smaller than most of the crossbred sheep of the range country. Numerous importations have been made into the United States, and the breed is well liked on the range where forage is fairly abundant and lush while growing. The Corriedale lamb is of excellent quality, matures fairly early, and is of medium size. For these reasons it is well liked by the packer and butcher. The fleece is of medium weight, good length, and usually of three-eights-blood quality. There are relatively few Corriedale ewes in the United States, and grade Corriedale rams usually find a ready sale.

Among the other more or less fixed crossbred types are the Columbia, Panama, and Romeldale. The Columbia (fig. 6) and Panama both have Lincoln and Rambouillet blood lines as their foundation, whereas the Romeldale is a cross between the Romney Marsh and Rambouillet. These crossbred types are of a more recent origin and

are not so well established as the Corriedale. The individuals are ordinarily larger and their fleeces are longer, heavier, coarser, and of somewhat less quality than those of the Corriedale.

SELECTION OF BREEDING STOCK

The selection of breeding stock depends on the phase of the sheep industry in which the sheepman engages, whether in the production of market lambs, stock sheep, or purebreds. It is commonly influenced also by range conditions and the capital, experience, and inclination of the operator.

MARKET-LAMB PRODUCTION

In market-lamb production the operator gives relatively more consideration to breeding for the production of lambs than of wool, but the successful operator does not overlook any practice that will



FIGURE 5.—Corriedale rams at the United States Sheep Experiment Station, Dubois, Idaho.

increase his revenue from wool. Most producers use rams of good mutton type and breeding on finewool or crossbred ewes.

In the sections that produce early lambs, the ewes are generally bred on pastures early in the fall and lamb in sheds from late in January to early in March. The lambs are raised on the valley and foothill ranges (fig. 7) and are marketed early in the summer before the low ranges dry up. In some valley sections, especially in California and Arizona, lambs are born in November and December and marketed in April and May. Aged ewes are frequently made use of in these sections where lambs are born during the period from November to March.

Another very general practice involves more strictly range production. The ewes are bred early in the winter, either on the range or in the feed lot, and drop their lambs on the range, usually during May. After the ewes are sheared, the bands are gradually moved toward the high mountains (fig. 8), and the lambs are finished on the abundant weed feed of these mountain areas. These lambs are marketed in September and October. Aged ewes ordinarily are not used in this type of operation.

STOCK-SHEEP PRODUCTION

In sections where range feed conditions are not suitable for fat-lamb production, the raising of stock sheep is more generally recommended and practiced. Most of the Plains areas, because of grass forage, scarcity of water, and absence of high summer range, are not suited to the production of fat lambs. The finewool type of sheep is very hardy, an efficient wool producer, and yields a lamb which is in good demand both for restocking and feeder purposes. For these reasons stock sheep are largely produced on the semiarid ranges. There is comparatively little early or shed lambing, most

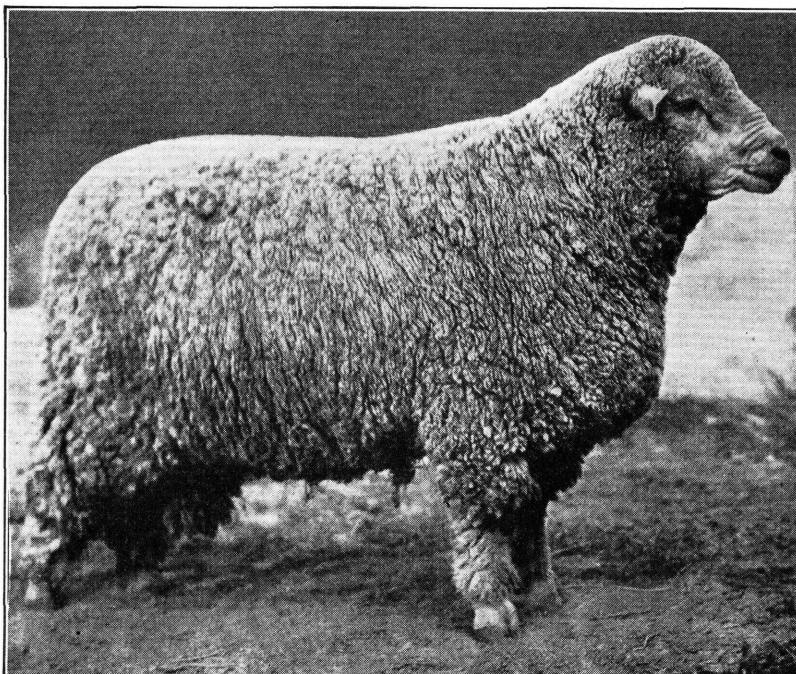


FIGURE 6.—A good type of Columbia ram produced by the Bureau of Animal Industry at the United States Sheep Experiment Station, Dubois, Idaho.

lambs being born on the range in May. They are weaned in September and October, and the wether lambs are sent to feed lots for finishing. The income from wool is relatively greater in proportion to the income from lambs for the producer of stock sheep than for the producer of fat lambs. Therefore, a great deal of attention is given to wool production, and in some sections of the Southwest it is given more attention than the conformation of the ewe and her ability to produce a desirable lamb.

PUREBRED-SHEEP PRODUCTION

Purebred-sheep production is a highly specialized branch of the industry and is ordinarily undertaken in the range country only for the production of breeding rams to supply the range operators. The

investment per ewe for breeding stock, equipment, labor, and feed is high, and unless the operator has the necessary capital and experience he should not undertake this branch of production. Many thousands of registered and other purebred rams are raised and sold



FIGURE 7.—A band of ewes and their lambs on the spring-fall range at the United States Sheep Experiment Station, Dubois, Idaho.

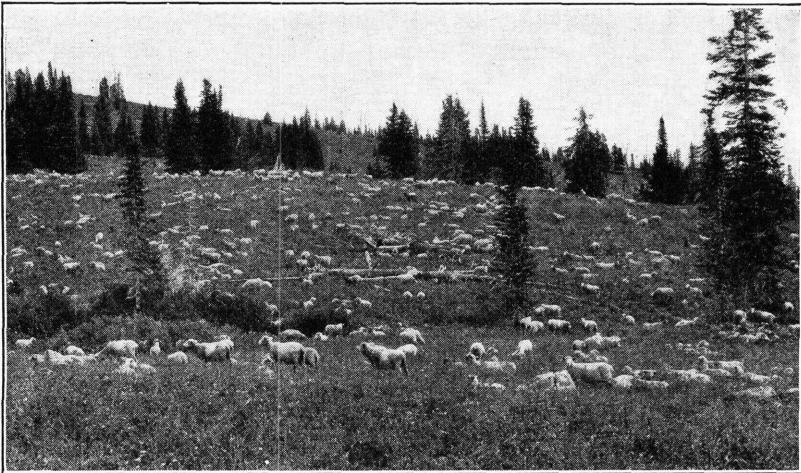


FIGURE 8.—Sheep on high mountain range.

yearly by private sale and through the auction ring. The principal breeds and types raised for the use of range men are the Rambouillet and Hampshires, and smaller numbers of Suffolks, Lincolns, and others.

SELECTION OF RAMS

After the breeder has decided on the general type, he should select rams superior in breed type, mutton conformation, and wool production. Since a ram may stamp his characteristics on from 20 to 100 or more lambs each season, the importance of care in selection of breeding rams cannot be overemphasized. The breeder should choose rams of the same general type as the ewes for purebred or stock-sheep production, and superior mutton-type rams for market-lamb production. It is a short-sighted policy for the breeder to use inferior or off-type rams.

SELECTION OF EWES

Regardless of the phase of the range industry undertaken, the operator must use great care in selecting his ewes, as well as his rams, if he is to obtain maximum returns. He should select for size, breed type, mutton conformation, age, soundness, prolificacy, and wool production.

Other things being equal, a ewe of average or large size will be a more economical producer than a small one, as she will return more pounds of wool and mutton for the feed consumed and the care given her. Breed type is particularly important in the purebred business, but under any circumstances the rangeman should strive for uniformity of type within his bands. The vigorous ewe of good mutton conformation is a far better potential producer than one of poor conformation.

The age at which ewes cease to be efficient on the range varies from 5 to 7 years. Finewool ewes generally are profitable longer than ewes of the mutton types. Soundness in ewes consists largely in freedom from defects in teeth, udders, and teats and from parasitic and infectious diseases. Although ewes that produce twins are more profitable than those that give birth to single lambs, it is better to have ewes raise single lambs every year than to have them raise twins only half the time and then fail to raise any lambs during the remainder.

Since one third to one half the income from the ewe is derived from her fleece, it is to the advantage of the raiser that his ewes produce heavy fleeces of a desirable quality of wool. The animals should be well covered with long, dense, uniform fleeces of the fineness characteristic of the breed or type. Wool production depends also on the manner in which the sheep are handled. Wool growth as well as body growth responds to favorable feed conditions.

REPLACEMENT OF EWES

To maintain the number and the desired average age of the band, the rangeman must replace the ewes he disposes of or loses each year with an equal number of young ewes. He may either raise or purchase these replacements. If the lambs raised are of the same type as the breeding ewes, the breeder ordinarily retains his own replacement stock. But when he uses black-faced rams on white-faced ewes to produce market lambs, he should market both ewe and wether lambs, for the black-faced ewe lamb is not desirable for stock purposes. In this instance the rangeman purchases his replacement

stock, either as lambs or yearlings, from a section where stock sheep rather than market lambs are produced. Oregon, Nevada, Montana, and portions of adjoining States furnish many white-faced ewe lambs annually for the market-lamb producer of the Northwest. In making his replacements the rangeman should be careful that his uniformity of type is not disturbed.

MANAGEMENT OF RANGE SHEEP

GENERAL ORGANIZATION

The range-sheep unit, or band as it is called, may vary considerably in size, but is usually composed of from 2,000 to 2,500 sheep. From lambing time until weaning approximately 1,200 ewes with their lambs are kept together in a band. After the lambs are weaned, two bands of ewes are combined for the breeding and winter-feeding period.

With slight variations and one notable exception, the sheep producers of the western ranges use the same general system in handling their sheep. They give a band into the care of one herder who, with his dogs, stays with the sheep day and night throughout the season. He is quartered in a wagon equipped for his needs, except during short periods when he is near headquarters or in the summer when he takes his sheep to high mountains where his wagon cannot follow. In this case he uses a tent. A camp tender, with his wagon and team or pack animals, attends to the herder's needs by supplying him with food and moving his camp as the sheep exhaust the grazing in the immediate vicinity. One camp tender takes care of two or more herders, depending on the distance he must haul supplies and the roughness of the country. In large organizations a range foreman usually is in charge of several bands on his particular allotment of range, whereas in smaller outfits of 1 or 2 bands the owner may take the place of both the camp tender and the range foreman. Additional help is required seasonally, especially during lambing and shearing.

The exception to this general method is found in some parts of the Southwest, particularly Texas, where sheep are kept in paddocks or pastures. Here the operators own or have long leases on nearly all their grazing land, an arrangement which enables them to build fences and let the sheep graze undisturbed in these large pastures. They employ fence riders at all times and additional help during lambing, but on a year-around basis one man can attend to a much larger number of sheep than he can under the herder system. The system just described has the additional advantage that when the sheep are unmolested they follow their own inclinations and make more complete utilization of feed.

Intelligent dogs, when obedient and otherwise properly trained, are valuable aids to the herder in managing his sheep. However, many untrained dogs are often found with sheep, and this situation is fully as bad as having no dogs at all.

BREEDING

The time of breeding in different localities varies, depending largely on range and weather conditions during lambing, but the

general principles involved are very similar throughout the range country. The sheepman desires that all ewes be bred to lamb in a short space of time, thereby insuring a lamb crop of reasonably uniform age. He also desires a good percentage of lambs. To obtain these results the progressive sheepman is coming to realize that it is essential to have a uniform band of thrifty ewes, good vigorous rams, and a breeding range with plenty of feed.

Many sheepmen set aside a part of the range particularly for breeding and do not harm it by allowing the stock to overgraze it before breeding time. They feed very little grain when breeding for early winter lambs, but when breeding for May lambs they generally feed some concentrate to the ewes. Feeding whole corn or cotton-seed cake on the ground at the maximum rate of one fourth pound per head per day is the practice usually followed. This feeding is ordinarily continued until the sheep are brought into the feed lot. When breeding for late-winter and early-spring lambs, most range-men plan to "flush" their ewes, that is, to give them extra feed at breeding time, in an effort to obtain a good lamb crop. They rent stubble fields and alfalfa meadows and allow the ewes to graze them during the breeding season so that the animals are gaining weight when bred.

Unless the rams are in good flesh before breeding time they should be conditioned with grain for from 3 weeks to a month before they are turned in with the ewes. From 1 to 2 pounds of whole oats daily is an excellent feed for this purpose. Unless the range is extraordinarily good, the usual practice is to continue grain feeding throughout the breeding season. Under different conditions and with different individuals various methods of handling the rams in the band are used. Many rangemen do not feed them at all, but take them out after a short period and substitute fresh rams. Other sheepmen feed their rams during the day and turn them in with the ewes at night, and still others feed their rams at night and turn them in with the ewes during the day. Any of these methods, if intelligently followed, will insure a good lamb crop. The number of ewes allotted to one ram on the range varies greatly, but ordinarily best results are obtained when 3 rams are allotted to each 100 ewes. The length of the breeding season also may vary, but the rams should be left in at least from 35 to 40 days.

WINTER HANDLING

The range sheepman may choose between wintering on the range and wintering in the feed lot. Most range sheep are brought into the feed lot at some time during the winter. The time varies considerably, depending on the condition of the sheep at the beginning of the winter, condition of the range, the quantity of feed available, and the severity of the winter. In some particularly favored locations and during mild winters the sheepman may allow his stock to graze for the entire winter.

WINTERING ON THE RANGE

Since the cost of wintering is one of the large items of expense for the range sheepman, he usually keeps the sheep on the range as long as possible in the winter. Many areas in the West are particularly

suited for winter ranges, and hundreds of thousands of sheep are grazed there each year (fig. 9). Notable examples are the Red Desert in southern Wyoming, and the Nevada and Utah desert areas. Three essentials of a good winter range are abundant feed, snow, or other form of moisture, and shelter in stormy periods. Areas with a deficient water supply ordinarily are good winter ranges because stock are not able to graze on them in the summer, consequently a good growth of range feed is saved until snow comes. The stock then are able to graze this range and to use snow to satisfy their water requirements.

Sheep browse a great deal during cold weather and utilize rougher feed than at any other time of the year. Many sheepmen make a practice of feeding some grain concentrate on the winter range each year, and some make provisions for an extra supply of feed that can be used during severely cold or stormy periods.

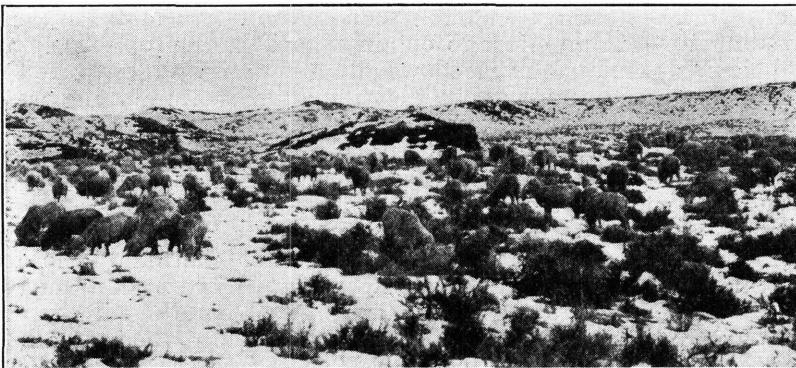


FIGURE 9.—Ewes on winter range at the United States Range Livestock Experiment Station, Miles City, Mont.

After being weaned, lambs should have an abundance of feed in order that their growth may not be retarded. A good common practice is to turn them into stubble fields and pastures until the feed is short or the weather becomes too severe, and then begin feeding them hay. It is often advisable to give them a small quantity of grain throughout the first fall and winter after weaning.

WINTERING IN THE FEED LOT

Alfalfa hay is the standard winter roughage for sheep in feed lots (fig. 10) in the range country, but some native hay is fed when alfalfa is not available. The hay is ordinarily purchased in stack at a price that may or may not include pasture privileges. If the pasture is obtained it is usually grazed by the ewe lambs and the old ewes that are unable to get their living off the range. Hay is hauled from the stack and fed on the ground. The feed ground should be changed often to prevent feed lots from becoming insanitary. Essentials of a good winter feeding ground are accessible hay, shelter, and water. Very little shelter, except a natural wind-break, is necessary. Some sheep come through the winter without

having had any source of water except snow to satisfy their water requirements, but when they are on dry feed it is decidedly preferable to have a supply of open water. If mature sheep are in thrifty condition when they are brought into the feed lot, grain is not usually fed with alfalfa hay, but a protein concentrate, such as cottonseed cake, is desirable when native hay is fed. In figuring hay requirements for a band of range sheep when hay alone is fed, the sheepman should allow not less than from 4 to 5 pounds per ewe per day, depending on its quality. He will, of course, allow less than this when grain also is fed. When conditions permit it is often the practice to feed a small quantity of hay and permit the sheep to graze each day.

Sheep are not able to utilize as rough and stemmy hay as some of the larger classes of livestock; for this reason sheep waste some-



FIGURE 10.—Ewes on winter feed lot near Hamer, Idaho.

what more first-cutting hay, unless it is of a very fine quality, than they do of the later cuttings. During extremely cold weather, and when sheep are first brought in from the range, it is wise to sort out the poorest hay and feed it first, as the sheep will eat it better at this time than later. The hay of better quality is then reserved for the end of the feeding period and during lambing. Great care should be taken in feeding hay that contains wild barley or foxtail. Seed heads of these plants do great damage when mature, especially to finewool sheep. The seeds not only get into the eyes and blind the animal but they collect inside the mouth and cause sores and starvation if not removed. The sheep should be examined carefully at short intervals for the purpose of removing seed heads. Hay containing foxtail should never be fed in racks. Moldy hay also is dangerous, particularly to ewes heavy with lamb, as it is a frequent cause of abortion.

Breeding rams may be wintered on roughage and a small quantity of grain since there is no object in getting them in high condition. From 5 to 7 pounds of fair alfalfa hay, depending on the size of the ram, and 1 pound of whole oats, form an ideal winter ration.

SPRING HANDLING

The largest problem confronting the range sheepman in the spring is lambing. His success at lambing time always has a very definite bearing on the income derived from his business.

SHED LAMBING

Early shed lambs are raised in many parts of the West for the purpose of getting the lambs on the market at a date somewhat ahead of the large run of range lambs. These lambs shipped late in the spring and early in the summer arrive at the markets at a time when the demand is brisk, the supply small, and prices relatively high. For successful lambing late in the winter or early in the spring it is necessary to have, in addition to sheds and other equipment, an abundant supply of feed and sufficient early range forage to finish the lambs after turning them out on the range. During lambing time an abundant supply of good hay and grain is necessary, and some form of succulent feed is highly desirable.

For from 3 weeks to a month before lambing, the ewes should receive some grain. Whole oats at the rate of one-half pound per ewe per day has proved to be a very good grain ration, but corn, wheat, barley, and various grain mixtures have been successfully used. Some corn silage, beet pulp, or other succulent feed may be fed in limited quantities before lambing and in larger quantities afterwards, to stimulate milk flow. The best quality of hay should be reserved for this time. The following rations have proved successful:

Ration before lambing	Ration after lambing
Alfalfa hay ----- 4 pounds.	Alfalfa hay ----- 5 pounds.
Whole oats ----- $\frac{1}{2}$ pound.	Corn silage ----- $2\frac{1}{2}$ pounds.
	Whole oats ----- $\frac{3}{4}$ pound.

These rations are suitable for average-size range ewes weighing from 110 to 140 pounds. Ewes with twin lambs may have their milk flow stimulated by receiving more grain and succulent feed. These rations include feeds that are commonly grown in the irrigated valleys of the West.

In shed lambing, a large number of laborers are necessary during lambing. They include the lambing foreman, hay haulers, feeders, drop pickers for day and night, sucklers (men to assist weak lambs), and men for moving small groups of ewes and lambs and for miscellaneous work.

The drop picker uses a low cart and gentle horse. When the lamb is born he loads the ewe and lamb into the cart and hauls them into the shed, where they are placed in a small individual pen. These pens are ordinarily 3 feet 6 inches square, arranged in a row down the sides and through the center of the shed. The suckler watches the lamb carefully for the first few hours after birth and if necessary gives it assistance in suckling. After the ewe and lamb have been together for from 12 to 24 hours and the lamb is mothered well, they are turned out into a larger pen with from 6 to 8 others. In this pen they have access to feed and water. Ewes are usually not fed in the individual pens but receive all the water they want. The small groups are watched carefully, and all weak or backward

lambs are returned to individual pens. After a day or so the small groups are further combined and from 18 to 20 ewes and their lambs are put in a larger pen with an outside run, so that the lambs may get the benefit of the sunlight. These pens should have good drainage and dry bedding at all times. This system of gradually combining the groups as the lambs grow older and stronger continues until there may be from 100 to 200 head in a group at docking time, when the lambs are from 10 days to 2 weeks old. The ewes are fed liberally until green feed appears on the range, and at that time they are combined into a summer band of from 1,000 to 1,500 ewes with their lambs.

Some sheepmen handle twin lambs in the same way as they do the single lambs, and others form groups of twin lambs, give them extra feed and care, and ultimately make them up into a band of twin lambs.

The main advantages of the shed system of lambing are: (1) The band may be lambed early before grass comes, and the lambs may be marketed correspondingly early; and (2) more care can be given to the band during lambing, resulting in a greater percentage of lambs raised. The number of lambs marketed commonly is well over 100 percent of the number of ewes nursing lambs in the band.

LAMBING SHEDS

In any locality where the lambs are born before green grass comes, shelter is necessary. Sheds may be constructed of lumber, galvanized iron, canvas, or straw, or large tents may be used. The interior arrangement of lambing sheds varies with almost every outfit, but the principle is the same in all. Small individual claiming pens, or "jugs", are provided where the ewe and new-born lamb can be placed. Then a system of pens is arranged so that as the lamb grows older the ewe and lamb are gradually combined with larger numbers of ewes and lambs. It is desirable, if not absolutely essential, that all the pens in which the lambs are placed after they are a few days old be provided with a shelter and an outside run. Figure 11 shows plans for a lambing shed and outside pens, and figure 12 shows the construction of individual pens within the lambing shed.

It is not always possible but it is highly desirable that space be provided in the shed for the lambing band. In cold stormy weather many lambs may be saved by having the lambing band under shelter. By some crowding the band can be accommodated in a space providing a minimum of approximately 6 square feet per ewe, but more space is preferable. Ample ventilation is essential, which may be provided by doors, windows, and overhead ventilators.

All doors through which whole bands of lambing ewes are to pass should be at least 12 feet wide, and preferably 24 feet, to prevent crowding on entering and leaving the shed. Small gates, doors, and other openings are one of the chief causes of abortion in ewes.

RANGE LAMBING

In range lambing the sheepman plans to have his ewes begin to lamb as soon as grass is available in the spring. A part of the range which contains suitable feed, shelter, and water is set aside for lamb-

ing, and the ewe band is moved in shortly before the lambs are due to be born. When the first lambs are born the day's drop, with the ewes, is gradually brought together before night, and the rest of the ewe band is moved away under charge of the herder. Flags or scare-crows are set up near the group of lambs and ewes, or fires are built to protect it from coyotes during the night. Similarly the lambs born on the bedground at night are left by the main band in the

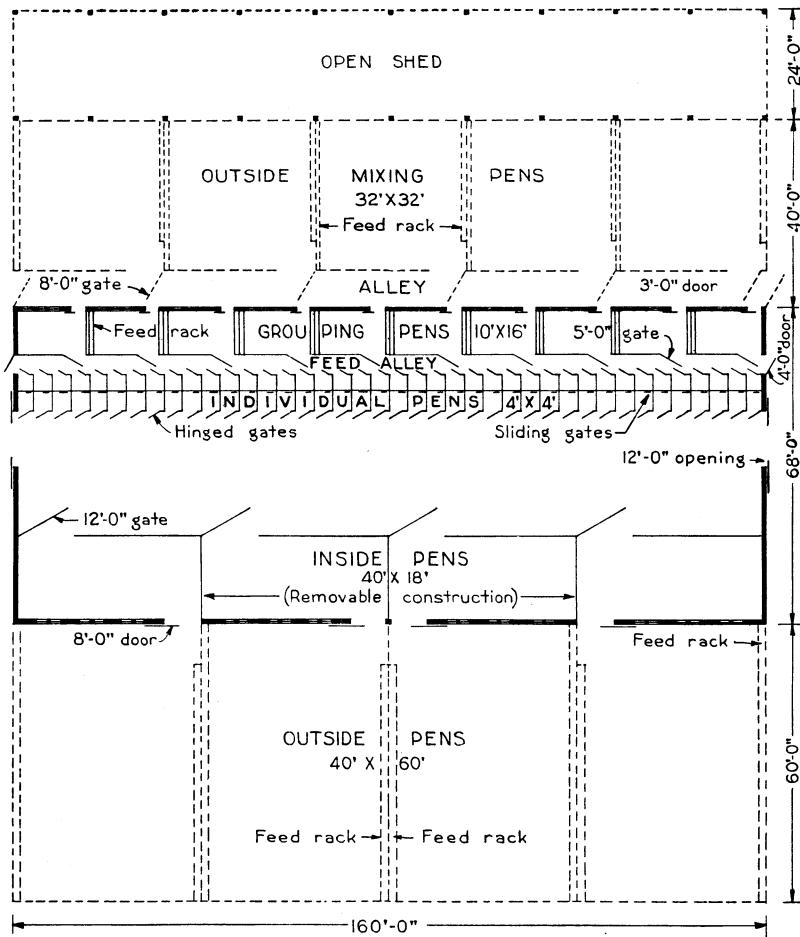


FIGURE 11.—Layout of lambing shed and outside pens.

morning. These small groups of ewes and lambs are given the best possible care, weak lambs are helped to suck, and as they become a little older and gain in strength they are combined until small bands of ewes and lambs are made up and given into the care of herders. Because these young lambs (fig. 13) are not able to travel long distances it is necessary that feed and water be close by.

Small tents are frequently used to protect ewes with new-born lambs during storms. Because of a lack of shelter and less indi-

vidual attention, losses on the range are a great deal heavier than in shed lambing. It is not unusual to lose practically all the lambs born during a severely stormy period.

CARE OF WEAK AND DISOWNED LAMBS

In either range or shed lambing, the sheepman makes every attempt to save all the lambs. Weak lambs may be revived by artificial respiration and the use of stimulants. Chilled lambs may often be saved by putting them near a stove, wrapping them in a warm pelt or sack, or immersing them in water at a temperature that is just bearable to the hand. After a lamb is revived it should be given small quantities of its mother's milk at frequent intervals until it is able to nurse unaided.

Frequently ewes disown their lambs. This trouble is particularly common among finewool ewes, yearling ewes, and ewes with an insufficient milk supply. If the lamb is energetic and strong, the ewe will almost invariably own and mother it if she is tied securely.

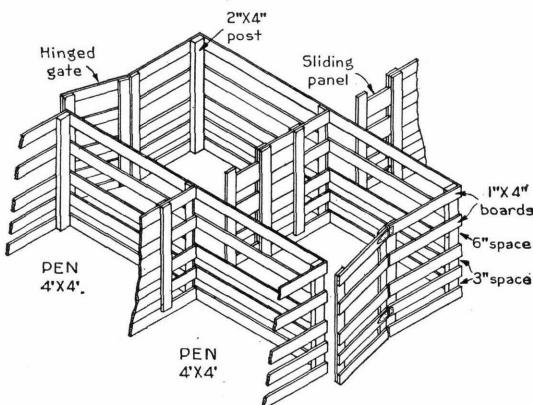


FIGURE 12.—Individual pens within lambing shed.



FIGURE 13.—A band of ewes with young lambs on spring range in Idaho.

or hobbled so that she cannot run away. A few hours may suffice with some ewes, whereas it may take days with others. A ewe that has lost her lamb at birth will generally claim an orphan lamb if it is rubbed with the dead lamb or the afterbirth, or it may only be

necessary to milk a little of the ewe's milk on the lamb's head and rump. If a lamb is several days old before it dies, tying its pelt over an orphan lamb is usually the most effective way to make the ewe claim the orphan. The good lamher is ingenious in finding ways to save orphan lambs and rightly figures that each one saved means additional money at weaning time.

CORRALS AND FENCES

Corrals and fences are a necessity in any type of sheep operation, particularly around lambing and shearing sheds for separating bands of sheep. They may also be needed at locations on the range distant from ranch headquarters for sorting sheep without undue trailing to permanent sheds. The size of corrals may vary, depending on the number of sheep to be handled at one time, but a corral 100 feet square, or of equivalent area, will provide enough room for a band of 1,000 ewes to rest comfortably overnight, or for 2,000 ewes to be held while they are being sorted. In all cases corrals should be located on well-drained land.

Fences are ordinarily of four types—panel, woven wire, ordinary barbed or smooth wire with the strands close enough together to prevent sheep from going through the fence, and lath fence. For all sheep, particularly lambs, the panel fence is preferable, but the cost of construction is somewhat higher than that of the other kinds. A desirable type of panel fence constructed of 1 by 4 inch material is shown in figure 14.

A fence made of heavy-gage, woven wire strung on posts set from 6 to 8 feet apart is very satisfactory under most circumstances (fig. 14). A 2 by 6 inch plank on the top and bottom improves a fence of this type. This fence affords no shelter as does the panel fence, and lambs are likely to crawl through unless the mesh is very fine.

Wire fence with the strands close to the ground and close together at the bottom is probably the least desirable of the four kinds of fence, but when it is regularly inspected and repaired it will serve for holding mature sheep. Ordinary wire fences of 4 or 5 strands are often converted into sheep fences by the addition of several tightly stretched wires.

Another type of fence that has proved to be very satisfactory, especially when a portable fence is desired, is the so-called lath field fence. This fence is constructed of lath woven together with wire, as illustrated in figure 14. It may be purchased in compact rolls, and with steel posts it makes a very desirable sheep-tight fence with the added advantage that it is easily portable.

If only sheep are to be kept in the enclosures, a 42-inch fence is usually high enough. The cost of the material, particularly the panels and woven wire, will be less for a low fence than for a high one. Gates should be as wide as possible, 12 feet being the minimum desirable width.

FEED RACKS AND TROUGHES

Suitable racks for the feeding of hay and troughs for grain are desirable, especially during lambing and when feed grounds are muddy. Most range sheep are wintered on fields where a great deal of room is available for clean feed grounds and the hay is scattered

on the ground. Corn or cottonseed cake is also fed very successfully on the ground as long as it is not muddy, but when the animals are confined in pens and corrals racks are desirable to eliminate waste.

The ideal feed rack is a combination hay and grain rack which does not permit feed to be wasted. For very fine quality hay having little waste a rack with a small space 2 to 2½ inches between the slats is good, but when the hay is coarser, with more waste, a greater distance between slats is essential.

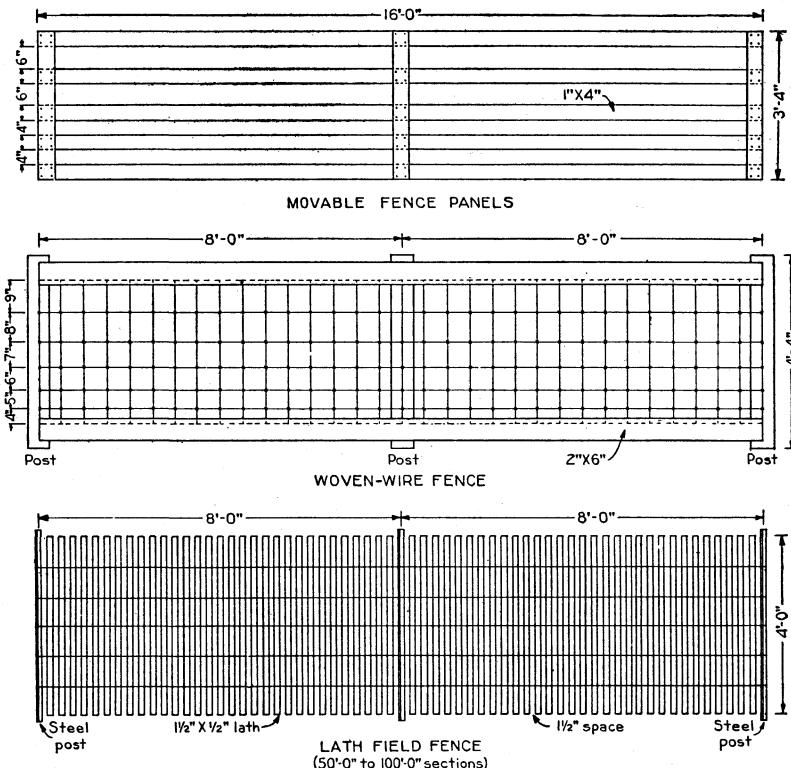


FIGURE 14.—Three types of fence used in range sheep production.

In many instances, particularly in commercial lamb feeding, the animals eat through specially constructed feed panels. As the lambs eat the feed within reach, more is pushed up to them. Self-feeding troughs and racks are sometimes provided for the feeding of chopped hay and feed mixtures with a chopped- or ground-hay base. The construction of these racks, troughs, and other equipment is discussed fully in Farmers' Bulletin 810, Equipment for Farm Sheep Raising.

WATER TANKS AND TROUGHES

The provisions for water and its conservation on some types of range are very important, as water is the limiting factor in sheep raising on much of the semiarid range area. Many ranges, particularly those for spring lambing, are made usable by the construction of dams and reservoirs to retain the natural run-off of water. Other

dry ranges have wells drilled to provide a water supply. In either case it is desirable to provide a system of troughs to water the stock (fig. 15). These troughs may be made of galvanized metal, wood, or concrete.

The arrangement of the water storage and troughs will depend upon the topographical conditions. One suggestion for a water supply is shown in figure 15. The tanks, preferably, should be located as close together as possible in order to conserve pasturage, but where two or more watering stations are required and the topography permits, they may be supplied from the same storage if it be of sufficient capacity. Concrete troughs should be made no longer than 60 feet and should be reinforced in order to provide against the development of cracks. Troughs built with the long side parallel to the hillside require less concrete than those built parallel to the direction of slope. A valve at the tank controls the supply to all the troughs. The desired water level is maintained in the several troughs by providing, in all but the last trough, overflow pipes connected with the next lower trough. Farmers' Bulletin 1772, Use of Concrete on the Farm, contains information on the making and

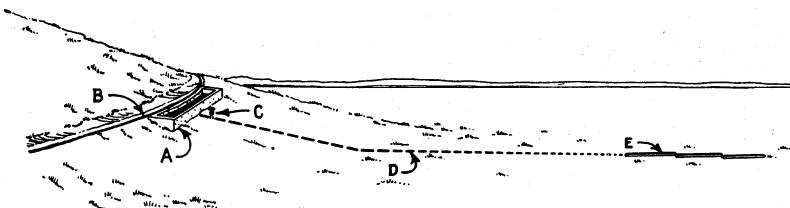


FIGURE 15.—Range-water supply for sheep: A, Concrete storage tank built into slope of watershed; B, collection ditch diverting snow water run-off into storage tank; C, control valve; D, pipe line; E, trough.

handling of concrete and the construction of concrete tanks and troughs.

Water requirements per head vary from three-fourths gallon to twice that quantity per head daily, depending on weather, type of range, and kind of sheep. Ewes nursing lambs or on dry ranges require more water than ewes without lambs or ewes on green feed. When storage and trough space is planned, the number of sheep and the length of grazing period on that particular range should be taken into consideration. On many ranges where it is impracticable to provide permanent supplies, water is often hauled long distances in tank wagons or trucks, and portable troughs or tubs are provided to water the animals. This latter method is expensive and ordinarily is used only in emergencies during extremely dry periods. The storage supply is conserved by the addition of a cover on metal or concrete tanks or by fencing to exclude cattle and horses (fig. 16).

DOCKING AND CASTRATING

It is the uniform practice in the western range country to dock all lambs and to castrate all ram lambs except those in purebred herds. As performed by the rangemen, docking and castrating are not long or tedious jobs. An efficient crew of five men commonly docks and castrates 200 or more lambs per hour. The common practice is to dock and castrate lambs at from 7 to 21 days of age, although no

serious trouble is experienced if the lambs are from 5 to 30 days of age. The tails may be seared off with a hot iron or cut off with a knife. The lambs are usually castrated by cutting off one third of the scrotum and pulling the testicles out with the teeth. This method is quicker and more sanitary than using the fingers. Recently several patented tools have been put on the market for docking and castrating, and good work can be done with these by experienced operators, although the process usually is somewhat slower with their use. On clean range with plenty of sunshine the effects of the operation will usually disappear in 12 hours.

SHEARING

TIME OF SHEARING

The time of shearing varies from February in some parts of the Southwest to July in the north. Most sheep in the western range

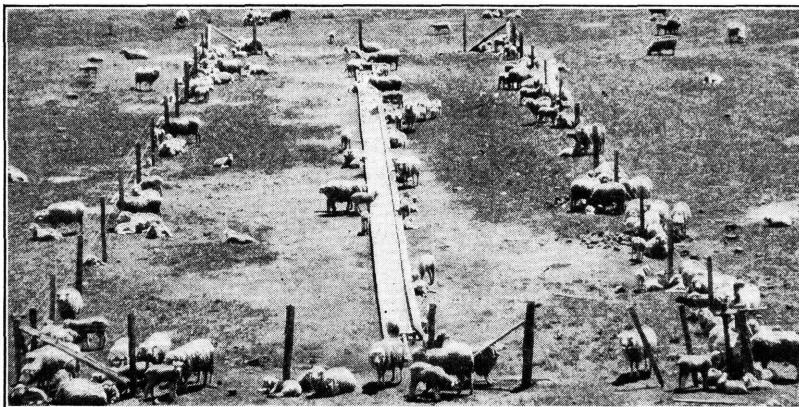


FIGURE 16.—Range watering troughs for sheep are fenced to exclude cattle and horses as a means of conserving the water supply for lambing time.

country are sheared in May and June. It is best to shear after the weather has become warm enough so that newly sheared sheep will not suffer from exposure. Wet snowstorms and severe cold are sure to cause heavy losses among sheared sheep. Some range men shear before lambing, but the most of them wait until after lambing. The advantages of shearing before lambing are that the wool is removed from around the udder, making it easier for the lamb to suck, and less trouble is experienced with maggots, the source and cause of which are discussed later. The disadvantages are that the sheep often are sheared too early and are in danger of loss through exposure, and there is danger of causing abortion when ewes heavy with lamb are sheared.

SHEARING SHEDS AND EQUIPMENT

Buildings for sheep shearing and for handling the wool vary from crude temporary sheds and stalls of corrugated iron, canvas, and other materials, to permanent sheds. The better types of shearing sheds provide means for sweating the sheep to make shearing easier,

convenient pens for holding the sheep before and after shearing without mixing sheared and unsheared sheep (fig. 17), a clean space for shearing the sheep, and suitable equipment for sacking and storing the wool.

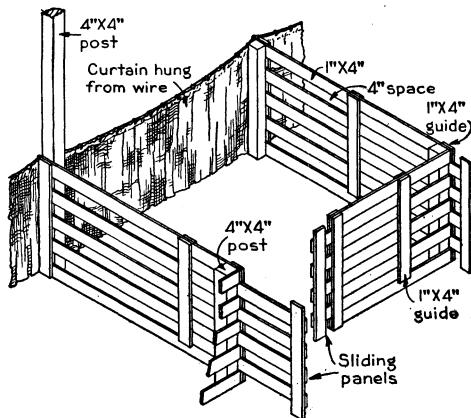


FIGURE 17.—Holding pens with sliding panels.

In the past hand-shearing was very popular, and many thousands of sheep are still sheared in this way, but most of the sheep in the range country are now sheared with machine shears. The use of the

shearing shed is desirable that the shearing shed be easily accessible both to the range and shipping points. Figures 18, 19, and 20 show plans for shearing sheds.

In some parts of the country operators of small bands trail their sheep to commercial plants and pay a fixed price per head to have them sheared, but operators of large bands generally have their own shearing equipment.

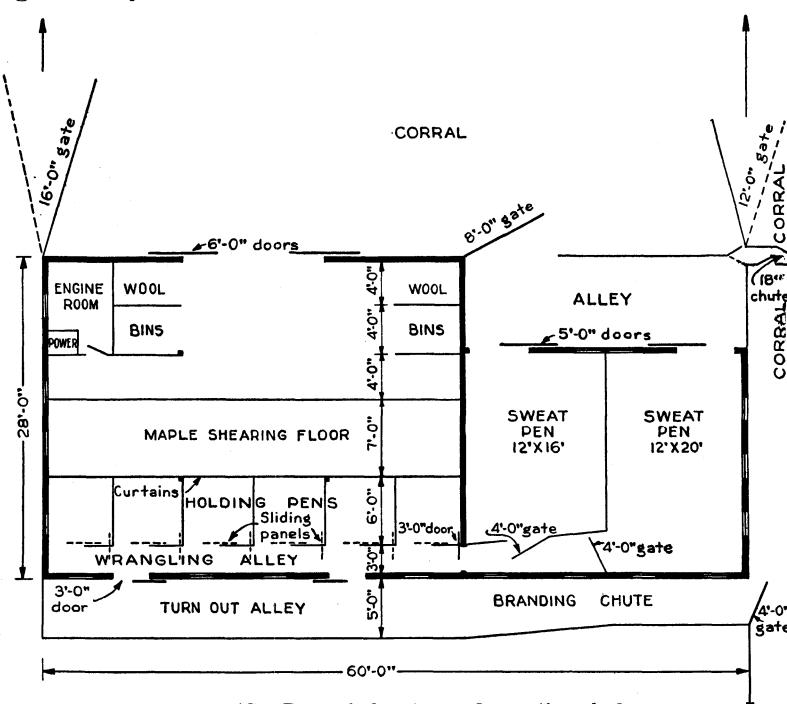


FIGURE 18.—Plan of shearing and sweating shed.

latter system has the advantage of being quicker, and the wool is taken off more closely and uniformly, with fewer second cuts and greater length of staple. Some operators think that machine shears

take the wool off too close, thereby exposing the sheep to the danger of storm, and for that reason they have their sheep hand-sheared.

CUTTING AND MOUTHING CHUTES

An efficient chute for separating or "cutting" sheep is an absolute necessity on every sheep ranch (fig. 21). Much use is made of it in separating ewes from lambs and sheared from unsheared sheep, and in making up the breeding bands. In connection with this chute a convenient place for mouthing (examination of the mouth), branding, and culling is desirable.

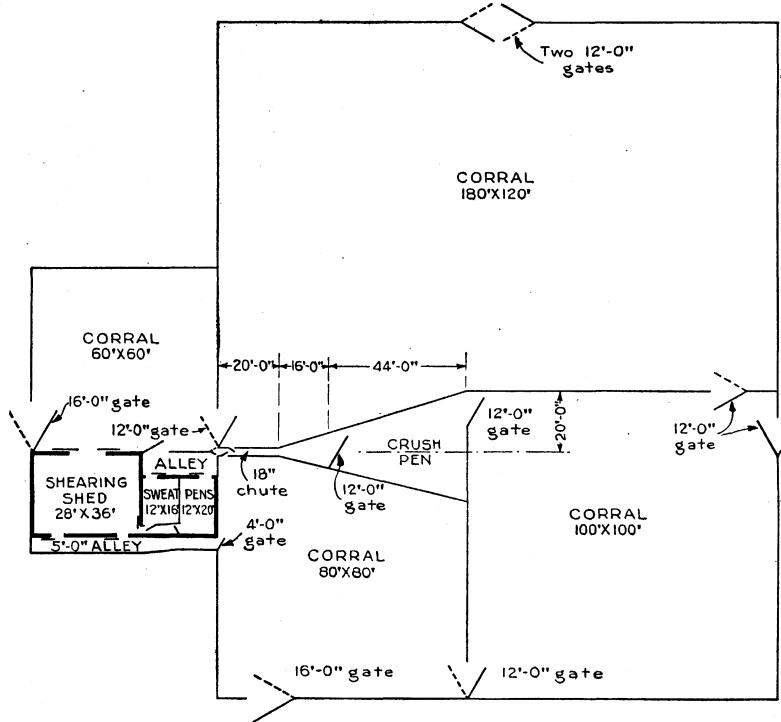


FIGURE 19.—Plan of shearing shed and outside corrals.

The chute should be long enough so that earmarks and brands on each sheep can be read easily and correctly before the animal reaches the cutting gates. The chute should be solid and high enough to prevent sheep from jumping over, and narrow enough so that they cannot turn around. In the crush pen (pen with movable side that holds sheep firmly) immediately in front of the chute, a panel may be conveniently placed to form a pen where sheep can be mouthed or branded. They may then be run through the chute and sorted into their respective divisions.

HANDLING WOOL AT SHEARING TIME

The careful shearer takes off the fleece so that it remains intact and avoids cutting the sheep and making second cuts in the fleece. One

active man can take care of the shearing "board" (floor) for 5 or 6 fast shearers, tie the fleeces, and sweep up the tags. As the fleece comes off the ewe the tier removes all heavy tags, dung locks, and badly stained wool, rolls the fleece into a compact bundle with the loose ends inside, and ties it with hard paper twine. Binder and

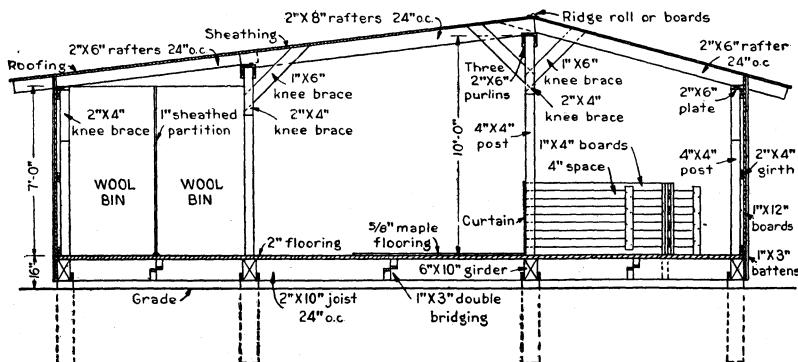


FIGURE 20.—Cross section of shearing shed.

jute twines should not be used as they leave in the fleece ravelings that pass unnoticed and fail to take the dye when the wool is made up into cloth. Manufacturers are seriously concerned about this problem, and earnest efforts are being made to have all fleeces tied with paper twine. After being tied, the fleece is sacked with other

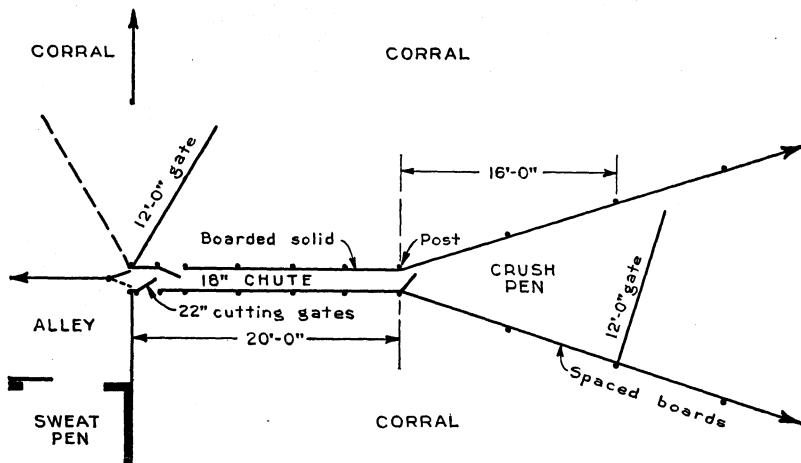


FIGURE 21.—Plan of cutting chute.

fleeces of its kind. A careful record should be made of the number, contents, and weight of each sack, and the name or brand of the owner should be printed on it. All black and buck (ram) fleeces should be sacked separately. Whenever a black sheep is sheared the board should be cleaned carefully in order that objectionable black fibers may not be mixed with the next fleece.

SUMMER AND FALL HANDLING

DIPPING

Dipping is resorted to on the range to control two very troublesome sheep parasites, the common sheep tick and the scab mite. Of the two, the tick is far more prevalent and the scab infestation the more severe and difficult to combat. Dipping in the correct manner and with the proper solutions is the only successful method of combating these infestations.

Severe infestations of sheep by ticks are very common in many parts of the range country. The damage done by these parasites is underestimated by the average rangeman. Sheep heavily infested with ticks are irritated to such an extent that they lose flesh, and the value of their wool is lowered by the discoloration due to the presence of the ticks. Lambs particularly suffer when ticks are prevalent, for after the ewes have been sheared the ticks remaining on them get on the lambs and retard their growth and fattening. The standard coal tar and nicotine sulphate dips are satisfactory for the eradication of ticks, but in order to destroy the pupae it is necessary to dip twice at intervals of from 24 to 28 days. Many rangemen locate their dipping vats conveniently near the shearing plants and dip the ewes as soon as the shearing cuts have healed. At this time the sheep do not carry so much of the solution out of the vat as when the fleece is longer. The general practice in a tick-infested country is to control the parasite by dipping once each year rather than to attempt complete eradication.

Formerly the scab mite was very widely distributed, but quarantine restrictions and compulsory dipping have cleaned it out of a large part of the range country. Sheep infested with the scab mite are irritated and restless and attempt to bite and scratch the infested area. This irritation causes a loss of flesh, and if the mites are not controlled in time the wool falls off in large areas and leaves scabby sores. Because of the weakened conditions, scab-infested sheep have little resistance to other diseases, and much loss occurs. Both the nicotine-sulphur and lime-sulphur dips are effective. To be effective a second dipping must be made at from 10 to 14 days after the first. The Bureau of Animal Industry of the United States Department of Agriculture maintains inspectors in the western range country to direct and supervise dipping operations. Further information in regard to dipping is contained in Farmers' Bulletins 713, Sheep Scab; 798, The Sheep Tick, Its Eradication by Dipping; and 1330, Parasites and Parasitic Diseases of Sheep.

Makeshift vats are often constructed of wood or metal sunk into the ground, but they are generally unsatisfactory because of the labor connected with dipping in them and the fact that they are not usually long enough to allow the sheep sufficient time in the solution. The proper kind of vat has convenient holding pens in front and a chute leading up to a steep incline from which the sheep slide into the vat proper. The vat should be narrow enough to prevent the sheep from turning around, deep enough so that the sheep may be completely submerged, and long enough so that in swimming to the end the animals will remain in the solution a sufficient length of time to kill the ticks or scab mites. At the exit end of the vat a drain should be provided to carry the excess dip draining off the

sheep back into the vat. Some method of heating the dipping solution is also necessary. Plans for a dipping vat are contained in Farmers' Bulletin 798, *The Sheep Tick, Its Eradication by Dipping*.

TRAILING

Because of the increase in settlements and fenced areas, the range sheepman year by year finds his spring and summer range farther from his winter feeding or lambing quarters. This often necessitates long drives with his sheep through lanes and across overgrazed areas where feed and water are scarce. This is the cause of much inconvenience to the sheepman and loss of condition of the sheep. In addition, hungry sheep on a long trail are very likely to eat sufficient quantities of poisonous plants along the way to prove fatal. As much as possible, the sheepman should avoid conditions that will necessitate long trailing.

SUMMER RANGES

Summer ranges vary from the lush weed ranges of the high mountain districts to the Plains areas where there is little difference in the grass the year around, except that it is green in the spring and early in the summer and dry or cured the rest of the year. In the Plains areas handling problems in summer differ very little from those in the spring, fall, and winter except that the necessity for shelter is not so great and in dry districts the amount of country grazed is limited not only by the quantity of feed but by the available water.

In the national forests and other high mountain areas an entirely different method of handling the sheep in summer is used. Grazing on the national forests is under the supervision of local forest rangers, and certain restrictions in regard to bedding down at night, watering, changing camp, and salting are imposed. The common practice is for the herder to direct rather than herd his sheep in an effort to utilize the feed most fully. Under ideal conditions the band moves off the bedground at an early hour in the morning, then scatters out and grazes until it begins to get warm. The sheep water at some convenient place in the middle of the day and then move off into the shade of the timber and rest until it turns cool in the afternoon. In the meantime the herder cooks his food, moves his bed and tepee to the new bedground, and scatters a little salt nearby. Late in the afternoon the sheep begin grazing again and are gradually moved to the new bedground, reaching it just before dark.

An additional advantage is that the feed is not destroyed by being trailed down or its future growth hindered on and near permanent bedgrounds. Experiments conducted by the University of Nevada showed that, in a 100-day summer-grazing period, lambs handled under the bedding-out system were 7 pounds heavier, on an average, at weaning than lambs handled under the central-camp or permanent-bedground system. Seven pounds per head in an average band of 1,250 lambs means 8,750 additional pounds. At customary lamb prices this saving amounts to between \$500 and \$1,000. The system of changing the bedground frequently and the herder's "bedding out" with the sheep wherever night overtakes them has become a standard practice in the high range country.

In summer, the death losses on the high ranges are ordinarily higher than at any other time of the year, except during lambing. This is due to the rough nature of the country and the prevalence of poisonous plants and predatory animals. Losses, however, may be materially reduced by the watchfulness of a dependable herder.

The time of going on an allotment of summer range is largely seasonal. Forest officials regulate this on the grazing lands of the national forests. In general forage should not be grazed when it is immature, for this practice will seriously hinder the growth in future years. The sheepman should be guided by the development of his forage and allow the animals to graze the lower levels first, thus permitting the later forage on the higher levels to mature. Sufficient forage should be left on the ground to insure reseeding. The time of leaving the summer range will depend on the weather as well as on range conditions and marketing time. In many mountain areas heavy snows fall early in September.

MARKETING

FAT RANGE LAMBS

After the lambs attain the desired finish and weigh from 75 to 85 pounds, the bands are trailed to shipping points, where the lambs are separated from the ewes and sent to market. Most of the fat range lambs are sent to Chicago and other middle-western markets. On their arrival at the market all lambs with sufficient finish are slaughtered, and those lacking the proper finish are sold as feeders and fed until they are fat. The percentage of fat lambs produced on the high mountain ranges, especially of the northern and central regions of the West, varies with the season. Some years it may be less than 50 percent of the lambs marketed and in more favorable years much greater.

FEEDER LAMBS

A very large percentage of the lambs produced in the range country are not sufficiently fat, when weaned, to go directly to the butcher. The more common method of handling these lambs is to sell them for further feeding. Early in the season the grower may contract his lambs at a certain price to be delivered at a specified time. The buyer may be the feeder, but more often he is working on a commission basis and turns the lambs over to the feeder. A few sheepmen feed their own lambs or dispose of them to a local feeder, or they consign them to a commission firm in the central markets which sells to lamb feeders.

FEED-LOT LAMBS

In recent years the practice of fattening western lambs on western feeds has increased greatly (fig. 22), particularly in districts where beet by-products are readily obtained. Many thousands of lambs are fattened annually in Colorado, Montana, Idaho, and other Western States. Beet by-products, corn, barley, and wheat are used, with alfalfa hay supplying roughage. These lambs when handled in the proper manner attain a degree of finish that compares very favorably with the corn-fed lambs of the mid-western feed lots. When fat, these lambs are shipped to Chicago, other central markets, and the Pacific coast.

PUREBREDS

The raiser of purebred sheep in the range country may sell some ewes to other raisers of purebreds, but his main source of income is from rams sold to the range operator. The raiser usually sells these rams as yearlings but occasionally as ram lambs and rams older than yearlings. Private sales and auction sales are the two main ways in which these rams are marketed. Throughout the range country ram sales are held each fall by district, State, and national wool growers' associations. The rams are sold by auction, and in each sale from a few hundred to several thousand animals may be offered.



FIGURE 22.—Lambs in the feed lot. (Courtesy of the State Agricultural College of Colorado.)

SURPLUS EWES

There are two common outlets for ewes which are culled from the flock each year. They may be sold to an operator in the range country who will lamb them early, give them excellent care, and put them on the market with their lambs, or they may be sold in small groups to farmers in the farming sections of the West or Middle West. Under farm conditions these ewes are ordinarily good for another year or two. A few culled ewes are sent to central markets, where they may be slaughtered or resold to middle-western farmers. The number of ewes culled from the herd each year may vary from a very small number to one fourth of the total.

CULLING

The practice of weeding out aged and undesirable ewes from the range flocks in order to keep production to the maximum is a very desirable and necessary procedure. In general all sheep should be disposed of when they do not have a reasonable chance of living through the coming year, of weaning a marketable lamb of good size, or of producing a desirable fleece. The ewe band at breeding time should represent high potential production, and this can be obtained only by severe yearly culling in the fall with a definite standard in view. It has been found practical to cull sheep on the basis of the following factors:

Age.—Age of the ewe influences her production to a marked degree. At the age of 1 year the ewe returns only the wool clip. At 2 years she generally produces a lamb, but lamb production in a flock is likely to be smaller at 2 years of age than for several years afterward since few 2-year-old ewes produce twins. This applies particularly to finewool sheep. After a ewe is about 5 years old there is a tendency for the teeth to become defective, and she is then unable to utilize her feed to the best advantage for her own maintenance and the production of wool and lambs. As the ewe gets older the teeth become uneven, spread, and finally are lost. All ewes should be culled when the teeth first become defective.

Size.—Small, undersized ewes are generally less profitable than those of average or large size, and it is good practice to cull them from range bands. The returns from them in lambs and wool are usually less, and they are not so able to stand the rugged conditions of the range as more robust ewes.

Type and conformation.—For the production of a uniform lamb crop and wool clip it is necessary that the ewes be of uniform type. Ewes with light bones, long legs, poor constitution as indicated by shallow bodies and narrow chests, and other faults of conformation are poor producers, on an average, and should be culled.

Low prolificacy.—The return per ewe depends on the production of both wool and lambs, with the lamb return usually the more important. It is necessary, then, that the ewe raise a fair percentage of lambs; otherwise she will not pay for her keep. A ewe chronically dry or unable, because of spoiled bag or inadequate milk production, to raise and wean a lamb should be culled. The fact that a ewe does not raise a lamb one year is no indication that she will not do so the next, but it is considered good practice to cull a ewe that for two successive years fails to produce a lamb.

Fleece weights.—The fleece production of a sheep is influenced by two important factors—individual differences and environment. To a lesser degree it is also influenced by sickness or other causes that impair the condition of the animal. Experimental evidence tends to show that a ewe producing a light fleece one year probably will do so in succeeding years. Accordingly, it is desirable to cull light-shearing animals from the flock. The culling standards for fleece weight should be based roughly on the average production of the entire flock, and when it is practicable to take fleece weights, those ewes falling far below the average should be disposed of. The number that can safely be culled will depend also on the type of operation and the availability of replacement stock. Practice will enable the grower to cull his light-shearing ewes by examination of the fleece for such factors as length, density, fineness, and shrinkage, when it is not practicable to weigh each fleece. Usually it is not convenient for the range operator to take fleece weights at shearing time.

Fleece quality.—Regardless of the breed or type of animal a desirable fleece should be of combing length for its grade, strong throughout the length of fiber with no marked unsoundness or "breaks", distinct and regular in crimp, elastic in its stretch, bright or lustrous, moderate in amount of grease, uniform from neck to breech, and light shrinking for its grade. Unsoundness and shrinkage because of dirt are largely due to environment and are not usually the fault of the individual sheep. Fleeces which are short and

loose, exceedingly heavy shrinking, and lacking in uniformity, are very undesirable, and animals producing such fleeces should be culled out. Black fibers or kemp and gare hairs (straight, coarse, glossy fibers sometimes found mixed with fine wool) are also objectionable in a breeding flock.

Unsoundness.—Various other causes may make it undesirable to retain sheep in the breeding bands. Cripples, blind ewes, "lungers" (ewes with chronic progressive pneumonia), or other diseased animals have their production ability seriously lowered and for this reason are unfit to retain.

WOOL

There has never been a standard uniform method of marketing the range wool clip. But however it is marketed, the bulk of the yearly clip ultimately arrives at one of the two main wool centers on the Atlantic coast—Boston or Philadelphia. Boston is the largest wool-marketing center in the United States.

A large portion of the western range clip is marketed by consignment to commission houses. These houses may be individual firms or cooperatives controlled by the growers. When the clip is handled through these commission firms, the grower, if he so desires, usually obtains an advance payment before shearing and an additional advance when the wool is loaded for shipment. After the wool reaches the market it is graded and later sold. Interest on the advances and the carrying and handling charges are then deducted from the selling price, and the remainder is sent to the grower. The disadvantage of this system is the fact that on a slow market it may be several months before the wool is sold, and the longer it is held the greater the charge against the clip for storage and interest on the advance payment. However, handling through a cooperative affords the grower some assurance that his product will command its true value. The National Wool Marketing Corporation, which the growers have organized, is endeavoring to aid wool growers in selling their wool. This corporation has headquarters in Boston and constitutes a federation of a large number of State and regional cooperative wool-marketing associations.

When sufficient wool can be gathered together in a lot, either by an individual or by a number of individuals in a pool, it is frequently offered and sold at the highest bid to wool merchants. The wool in these pools may or may not be graded before being offered for sale. Although this local-pool method of selling wool sometimes results in simple transactions quickly completed, it often has the disadvantage of hindering the efforts of growers who are attempting to effect national cooperation in wool marketing.

MARKET GRADING OF WOOL

It requires technical knowledge and many years of experience to determine accurately the market grades and shrinkage of wool; but any practical sheepman can separate the fleeces of his ewes, yearlings, and bucks, and the black fleeces and tags, and further grade his wool within broad limits. The generally accepted market grades of wool officially established by the United States Department of Agriculture are as follows:

Grade:	Numerical designations
Fine	64's, 70's, and 80's.
Half blood	58's and 60's.
Three-eighths blood	56's.
Quarter blood	48's and 50's.
Low quarter blood	46's.
Braid	44's.
Common	36's and 40's.

There is a further subdivision of market grades of wool, depending on the length of staple. The longer fiber or combing wools are desirable and often command a higher price on the market than the shorter or clothing wools. Combing wools are used for worsted cloth and the clothing wools for the softer woven woolens, felts, and similar materials.

Shrinkage of wools varies greatly with the fineness of the wool and the type of range on which it is produced. Dirt and sand make up, roughly, three fourths of the total shrinkage and grease the remaining one fourth. Extremely fine wools may shrink from 75 to 80 percent and some of the coarser wools only from 45 to 50 percent. An average shrinkage of western-range wools is about 60 to 62 percent.

Table 1 shows, roughly, wool grades from the various types and breeds of sheep commonly raised on western ranges.

TABLE 1.—*Types and breeds of sheep in relation to the kinds of wool they produce*

Type or breed of sheep	Grade of wool	Classification of wool as to length of staple
Merino	Fine	Strictly combing, French combing, and clothing.
Rambouillet	Fine and half blood	Do.
Hampshire	Three-eighths blood and quarter blood	Strictly combing, baby combing, and clothing.
Suffolk	Three-eighths blood	Do.
Corriedale	Half blood and three-eighths blood	Strictly combing and baby combing.
Lincoln	Low quarter blood, common and braid	Strictly combing.
Crossbred (longwool x fine-wool)	Half blood, three-eighths blood, and quarter blood	Strictly combing and baby combing.

The following tentative classification of wool as to length of staple (table 2) has been suggested by the Bureau of Agricultural Economics of the Department on the basis of preferences expressed by many who are engaged in the wool industry.

TABLE 2.—*Tentative classification of wool for length of staple (inches)*

Grade	Strictly combing	French combing	Baby combing	Clothing
Fine	Over 2	1 $\frac{1}{4}$ -2	—	Under 1 $\frac{1}{4}$.
Half blood	Over 2 $\frac{1}{4}$	1 $\frac{1}{4}$ -2 $\frac{1}{4}$	—	Do.
Three-eighths blood	Over 2 $\frac{1}{2}$	—	1 $\frac{1}{2}$ -2 $\frac{1}{2}$	Under 1 $\frac{1}{2}$.
Quarter blood	Over 2 $\frac{3}{4}$	—	1 $\frac{1}{2}$ -2 $\frac{3}{4}$	Do.
Low quarter blood	Over 3	—	2-3	Under 2.

The grades Common and Braid are not divided according to length of staple, as they are usually of strictly combing length.

CAUSES OF LOSSES

Losses of sheep and lambs can be reduced by good management, though their total elimination is probably too much to expect. The annual loss of mature sheep, as figured by range men, varies from 5 to 12 percent, depending on the locality and methods of handling. Causes of loss are numerous, but the main ones are poisonous plants, diseases, parasites, and predatory animals.

POISONOUS PLANTS

Large numbers of sheep are lost on the range each year from eating poisonous plants. Most of the loss occurs when, because of a shortage of feed, or because the animals are particularly hungry, they eat larger quantities of the poisonous plants than they do under normal conditions. Sheep that are abnormally hungry from coming off long trails, out of corrals, or after being shipped, often die in large numbers from eating poisonous plants. This also happens early in the spring when sheep are first turned out on the range, as the animals are hungry for green feed. Deathcamas, lupine, locoweed, waterhemlock, chokecherry, bitter rubberweed, Colorado rubberweed, whorled milkweed, and other plants cause severe loss when eaten under certain conditions.

OTHER PLANTS

Foxtail, alfalfa, and sweetclover sometimes cause losses, but they are good feed under most circumstances. Foxtail is a very early grass that has come to supplant better classes of range forage that have been overgrazed. Immature foxtail is a very good feed, and it is only when large quantities of the mature heads are in hay that the damage is great from this source. The beards and heads blind the sheep, pack around the jaws inside the mouth, and, if not removed, cause death. This kind of hay should be scattered on the ground and never fed in racks. The loss caused by grazing alfalfa and sweetclover is due to bloat, when range sheep are turned on pastures. It is generally considered that the danger from bloat is lessened when the pasture is dry and when the sheep are given a fill before grazing pastures of this type. Some small operators graze sheep the year round on alfalfa and sweetclover pastures without abnormal losses from bloat.

DISEASES

Among the many diseases of sheep, necrobacillosis (lip-and-leg ulceration), scours, navel ill, pneumonia, "lunger" disease, goiter, bighead, diarrhea, and the various disorders encountered at lambing time are common sources of trouble and loss. Since sheep do not yield to treatment so readily as most other livestock, the range man should devote his main effort to preventive measures. Sanitation, particularly around sheds and corrals, is a most important measure to be taken in disease prevention. All accumulations of manure and old bedding should be frequently removed from sheds and corrals, and the ground should be allowed to dry out with the aid of fresh air and sunlight. Whenever sheds are constructed provision should be made for as much sunlight as possible, since it is the best disinfectant. Farmers' Bulletin 1155, Diseases of Sheep,

discusses the cause, symptoms, diagnosis, and treatment of sheep diseases.

PARASITES

External parasites, including scab mites and various kinds of ticks, are common enemies of sheep. The effect of heavy infestations and their control have previously been discussed.

It is commonly and erroneously supposed that range animals are free from most internal parasites, such as stomach worms, tapeworms, and liver flukes, but post-mortem examinations of large numbers of sheep show that some of these parasites exist, at least in small numbers, in most range sheep. The fact that range sheep graze over a large territory and normally are changed to a new bedground frequently prevents these internal parasites from becoming more troublesome. In many districts in the West where sheep have been confined year after year to small pastures, such parasites give a great deal of trouble. Under these conditions control depends on the same measures that are necessary in the typical farm sheep districts, namely, medicinal treatment and pasture rotation.

Other parasites that give serious trouble on the range during certain seasons when conditions are favorable are the ordinary fly larvae or maggots. In warm, wet springs, from lambing until shearing time and infrequently throughout the summer, maggots are very troublesome. Flies are attracted by, and deposit their eggs in, the dirty wool around the udder and tail head of the ewes, under the horns of rams, and in snagged places and shear cuts on sheep of all classes. Unless maggots are killed by applications of benzol or chloroform and the wound treated with commercial pine tar oil, the trouble may be fatal. In the southern part of the range area the screw-worm fly often causes heavy losses. The attack is induced by any injury such as a shear cut, a scratch or a sore mouth. Since blowflies and screw-worm flies breed in carcasses on the range, burning of dead animals is very important to prevent fly breeding and subsequent infestation of sheep.

Grub in the head is another fly larva that is troublesome under some circumstances. The young maggots are deposited on the nostrils of the sheep and crawl up into the nose and head, where they injure the membranes. Farmers' Bulletin 1330, Parasites and Parasitic Diseases of Sheep, discusses the symptoms, prevention, and treatment of the various parasitic diseases of sheep.

PREDATORY ANIMALS

Wolves, coyotes, mountain lions, bobcats, and other predatory animals, including an occasional stock-killing bear, destroy great numbers of sheep on the western range. All except the wolf are abundant on many national-forest areas, large parts of the public domain, and some private lands.

The coyote, probably the most aggressive of these predators, maintains itself in the face of advancing civilization and presents the major predatory-animal problem on western sheep ranges. Moreover, through the persistent warfare conducted against it by inexperienced individuals in many parts of the West it is becoming so wary of traps that its control is extremely difficult. It is a prolific

breeder and in a short time will reinfest an area in which complete control had previously been obtained.

The bobcat also takes a heavy toll from flocks, especially during the lambing season, since lambing is frequently conducted on the open range close to the broken country and rocky canyons that favor its presence. Sheepmen often choose such rough and rugged country, however, for lambing grounds because of the protection it affords against storms.

The chief prey of the mountain lion is deer; but lacking such food, this predator frequently turns its attention to the young of domestic stock, particularly lambs. The severity of its depredations is demonstrated by records in the Bureau of Biological Survey, an extreme example being furnished from western Colorado, where a single mountain lion killed 192 sheep in 1 night.

Bears, which are usually classed as game, are in general not predatory. When an individual animal develops predatory habits, however, it can be the cause of severe depredations to sheep on higher summer ranges.

The gray wolf has now been brought under control in States west of the one-hundredth meridian, though the Department of Agriculture maintains trained hunters to lessen its invasion of private ranges from national forests and other public domain, and at border points where this predator crosses from Mexico to Texas, New Mexico, and Arizona, and from Canada to the northern tier of States. Control of heavy infestations of predatory animals is being made possible by coordinated action of Federal, State, and private agencies under leadership of the Bureau of Biological Survey.

Confirmed sheep-killing dogs are also responsible for much damage. Losses include not only the sheep killed outright but also those that are crippled, those that abort, and those that die of exhaustion. Many western range States have stringent dog laws, though they are not always effectively enforced.

OTHER CAUSES OF LOSS

There are other serious losses to the sheepman that cannot be properly charged to any of the foregoing causes. Some sheep on the ranges die from unknown causes and are never found. Many stray away from the band and are lost. These animals are merely missing at counting time. Many ewes die at lambing time from parturition troubles. A number die each year from injuries caused by careless handling and excessive use of rough dogs. Every sheepman should make an effort to reduce his preventable losses to a minimum; this can only be done by employing reliable herders and giving every possible attention to proper management at all times.

The greatest loss of lambs usually occurs during and just after lambing. Though perhaps not entirely preventable, the loss can be lowered by having the ewes in condition to raise the lambs and by proper facilities and plenty of help during and after lambing.

Constant attention to the care of sheep almost always brings about an increased return.